AS COMPUTER SCIENCE DECEMBER 2024 MOCK

H046 – Computing Principles, Algorithms and Programming

Name: _____

Mark: /80 Percentage:

Grade:

Note: Calculators are not allowed. Duration of exam: 90 mins
Answer all questions.

Name: Mark: /80 Grade:

Section A – Computing Principles

1 Open source software has grown in popularity over the last few decades.

(a) Explain the difference between open source and closed source software.

[4]

(b) Explain why all closed source software is most likely to be compiled rather than run on an interpreter.

[2]

(c) State the name of a type of translator software other than a compiler or interpreter.

[1]

Linux is a popular open source operating system and Windows is a popular closed source operating system.

(d) Give **three** functions of an operating system.

[3]

2 Variables in programs contain specific types of data.

(a) Complete the table below to suggest a suitable data type for each piece of data.

Data	Data Type
'H'	Character
"Hello"	
35	
−2.625	Real
True	

[3]

(b) Show the denary number 35 as an 8-bit (unsigned) binary number.

[1]

(c) The character 'A' in the ASCII character set is represented by the denary value 65. Write the binary representation for the ASCII character 'H'. Show your working.

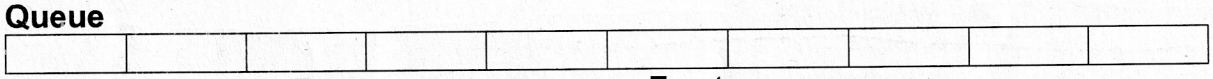
[2]

(d) Show the denary number $-2\frac{5}{8}$ as a floating-point binary number with a 6-bit mantissa and 4-bit exponent, both stored using two's complement representation.

[3]

3 The array queue shown below is set up to hold a small queue. Assume that there is sufficient storage to hold all necessary additions to the queue.

Queue



Rear Front

The table below shows variables that are used to maintain the queue:

Variable	Type	Purpose
front	integer	pointer to the front element of the queue
rear	integer	pointer to the rear element of the queue
Queue_full	Boolean	indicates whether the queue is full
max	integer	the maximum size of the queue

Shown below is an algorithm that is intended to add an item to the queue.

```
procedure add_to_queue (item)
     if ((front - rear) +1) == max then
          queue_full=true
     else
          front=front + 1
          queue[front]=item
     endif
endprocedure
```

(a) Identify the parameter that is passed to this procedure.

.....[1]

(b) Describe the logical decision that is made.

[2]

(c) (i) This algorithm contains a logic mistake. Explain what the mistake is.

[2]

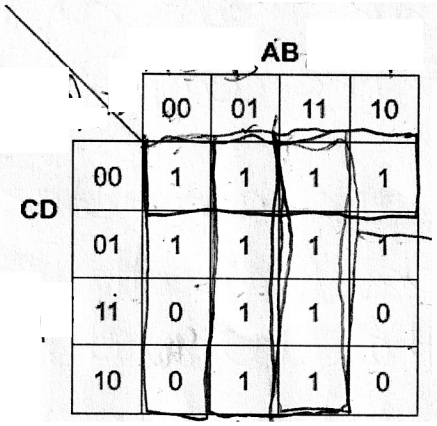
(ii) Rewrite the algorithm to correct the mistake.

[2]

4

A Boolean expression is entered into a Karnaugh Map.

(a) Give a simplified version of the expression using the Karnaugh Map. You must show your working.



CD \ AB	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	0	1	1	0
10	0	1	1	0

Simplified Expression: ..... **[3]**

(b) Draw a logic gate diagram to represent the expression below. **[4]**

$(\neg A \wedge B) \vee (\neg C \wedge D)$

5

Desktop operating systems are an essential part of modern personal computer systems (i.e. desktops and laptops).

(a) Describe how a desktop operating system is loaded when a personal computer is first switched on.

[2]

(b) Operating systems often come with utilities.

State a utility that might be supplied with a desktop operating system to help with system maintenance.

[1]

(c)* One of the key functions of an operating system in a personal computer is to manage system resources such as memory and CPU time. Discuss the different approaches a desktop operating system can take to managing these system resources and the relative advantages of each approach. [9]

Section B – Algorithms and Programming

1 (a) Describe what is meant by the term *IDE (Integrated Development Environment)*.

[2]

(b) Identify and describe **three** features commonly found in an IDE that will help programmers to find any bugs in their code.

[6]

2

☐ **(a)** Describe **one** difference between a global and a local variable.

[2]

(b) Explain, using **one** example, why global variables are sometimes used in a program.

[3]

(c) Explain why good programming practice generally avoids the use of global variables.

[2]

(d) Explain why parameter passing to a function can be a better alternative to using global variables.

[2]

3 (a) A bubble sort is performed on the following list:

3, 5, 8, 17, 12, 15, 18, 23, 1

(i) Describe how a bubble sort works. [3]

(ii) What is the sequence of the list after the first pass is completed? [1]

(iii) How many passes through the list will be required to sort the items into ascending numerical sequence? _____ [1]

(b) An insertion sort is performed on the same list as in part (a).

(i) Describe how an insertion sort works. [3]

(ii) What is the sequence of the list after the first pass is completed? [1]

(iii) What is the average time complexity of the insertion sort? [1]

4

(a) Describe the steps involved in a binary search to find the value 47 in the list below.

4, 7, 8, 21, 46, 47, 51

[4]

(c) The target integer 8 exists in a list of integers 1, 4, 6, 9, 8, 12, 15 but is not found during a binary search. There are no errors in the code.

(i) Give the reason why the target integer 8 is **not** found.

[1]

(ii) Identify and describe an alternative search algorithm that could be used.

[3]

END OF PAPER